See you later... crocodile?

The ecological diversity of the crocodylians and their relatives

Pedro L. Godoy
Archosauromorpha Research Group
School of Geography, Earth and Environmental Sciences
University of Birmingham

Background

Photograph credits.
Top: http://goo.gl/zGBonI
Below: http://goo.gl/UT2jkE

Can you tell the difference between a crocodile and an alligator? On the left, you will find an American alligator (*Alligator mississippiensis*) and a Nile crocodile (*Crocodylus niloticus*). As you can see, it is a tricky task for most people. Although they come in different sizes and have other slight differences, most modern crocodylians look pretty much the same to a non-specialist eye. Further, living crocodylians occupy a limited range of ecological niches. That is why our usual mental association of a crocodile is almost always with rivers or swamps.

However, the picture is very different when we consider the 200-million-year evolution of the crocodylian lineage. Many fossil species of Crocodyliformes, the group that includes crocodylians and their relatives, are completely different from the semi-aquatic forms we have today. These extinct crocodyliform species include fully sea-going forms with flippers, giant dinosaur-eating terrestrial predators, greyhound-like fast-running small omnivores, bizarre filter-feeders, and even plant-eaters with complex mammal-like dentitions.

Research Question

My PhD research project aims to investigate and understand which environmental and biological factors drove the evolution of this huge fossil diversity, and its decline towards the low ecological diversity seen today.

Image sources:
wikipedia.org;
ilcmuseum.org;
palaeos.com;
geothai.net;
wikiwand.com;
dinopedia.wikia.com.

Collecting Data

I collected anatomical data from hundreds of fossil specimens in museums and scientific collections worldwide and also from the scientific literature. This includes photographs of their skulls and also measurements from the animals' entire skeleton.

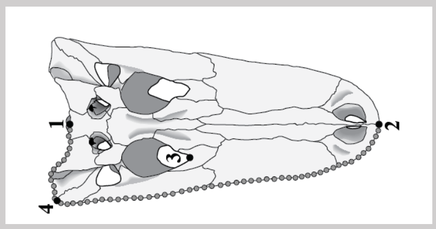
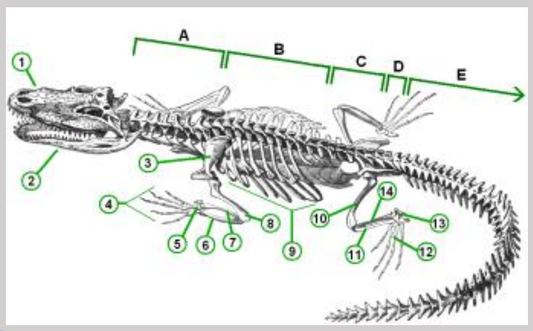
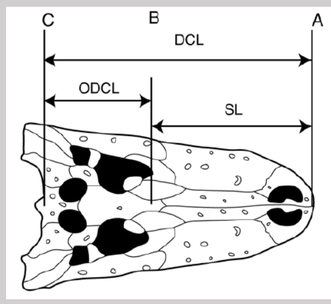


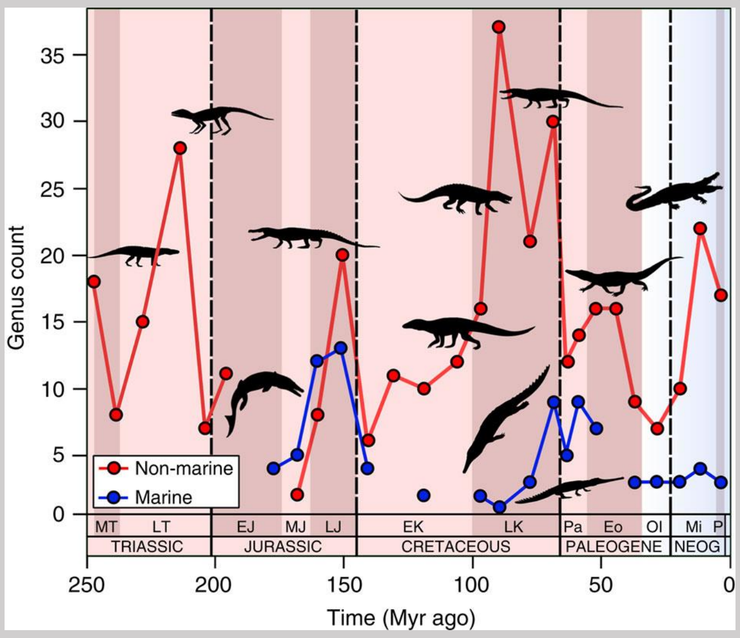
Image sources:
Wilberg (2012); wikipedia.org;
Hurlburt *et al.* (2003)





Analysing the Data

I will quantitatively analyse ecological diversity, which means that I am not exclusively interested on the number of species, unlike previous studies (see the figure on the right for overview of generic diversity of crocodylians through geological time). Thus, I will use the data I collect to estimate and analyse features that reflect the group's ecology, such as body size and mass, cranial shape, and morphological patterns in the skeleton related to ecological habits.



Generic diversity of crocodylians through time.
Figure from Mannion *et al*.(2015) illustrating increases and decreases in number of crocodylian genera. Did the ecological diversity follow the same patterns?

I aim to combine this information with environmental data (such as climate, geographic distribution or mass extinctions) and to test whether this ecological diversity follows the same pattern as species or generic richness. This will give me a more clear picture of which factors were driving the changes in the ecology of crocodylians. In understanding the interaction between the environment and the ecology of these animals in past times we will have more power to predict the impacts of the environmental changes ongoing today.

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Contact:
ResearchGate Pedro L. Godoy pedrolorenagodoy@gmail.com

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-Mannion PD, Benson RB, Carrano MT, Tennant JP, Judd J & Butler RJ (2015). Climate constrains the evolutionary history and biodiversity of crocodylians. *Nat. Commun.*, 6.
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